DECISION
AND
FINDING OF NO SIGNIFICANT IMPACT
FOR
REDUCING AQUATIC RODENT DAMAGE THROUGH AN INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM IN THE COMMONWEALTH OF VIRGINIA

The U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA-APHIS), Wildlife Services (WS) program responds to requests for assistance from individuals, organizations and agencies experiencing damage caused by wildlife. Ordinarily, according to APHIS procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions are categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6000-6003, 1995). To evaluate and determine if any potentially significant impacts to the human environment from WS' planned and proposed program would occur, an environmental assessment (EA) was prepared. The EA documents the need for beaver and muskrat damage management in the Commonwealth of Virginia and assessed potential impacts of various alternatives for responding to damage problems. WS' proposed action is to implement an Integrated Wildlife Damage Management (IWDM) program on all land classes in Virginia. Comments from the public involvement process were reviewed for substantial issues and alternatives which were considered in developing this decision.

The EA analyzes the potential environmental and social effects for resolving beaver and muskrat damage related to the protection of agricultural and natural resources, property, and threats to public health and safety on private and public lands in Virginia. Virginia has an area of 26,090,880 acres; in Fiscal Year (FY) 97, Virginia WS had agreements to conduct beaver or muskrat damage management on about 300 acres or less than 0.0012% of the land area (Management Information System (MIS) 1997). In FY 98, fifteen beaver and muskrat damage management projects were conducted on properties covering an area of about 917 acres or about 0.0035% of the land area of Virginia (MIS 1998). In FY 99 twenty-three beaver and muskrat damage management projects were conducted on approximately 14,050 acres or about 0.054% of the land area of Virginia (MIS 1999).

WS is the Federal program authorized by law to reduce damage caused by wildlife (Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c). Wildlife damage management is the alleviation of damage or other problems caused by or related to the presence of wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 1992). WS uses an Integrated Wildlife Damage Management (IWDM) approach, commonly known as Integrated Pest Management (WS Directive 2.105) in which a combination of methods may be used or recommended to reduce damage. WS wildlife damage management is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992, USDA 1997, WS Directive 2.201). The imminent threat of damage or loss of resources is often deemed sufficient for wildlife damage management actions to be initiated (U.S. District Court of Utah 1993). Resource management agencies and individuals have requested WS to conduct beaver and muskrat damage management to protect agricultural and natural resources, property, and wildlife, including threatened and endangered (T&E) species in Virginia. All Virginia WS wildlife damage management is in compliance with relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act of 1973 and Clean Water Act.

Virginia WS works and consults with the Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Agriculture and Consumer Services (VDACS), Virginia Department of Transportation (VDOT), Virginia Department of Forestry (VDOF), Virginia Department of Environmental Quality (VDEQ) and U. S. Army Corps of Engineers (USACE) to reduce wildlife damage. The VDGIF has the responsibility to manage all wildlife in Virginia, including federally listed T&E species and migratory birds, which is a joint responsibility with the US Fish and Wildlife Service (USFWS). Memoranda of Understanding (MOUs) signed between APHIS-WS and the VDGIF and VDACS clearly outline the responsibility, technical expertise and coordination between agencies. A Multi-agency Team with representatives and consultants from each of the aforementioned agencies convened to assess the impacts of WS beaver and muskrat damage management in Virginia. The VDGIF, VDACS and VDOT, VDOF and USACE worked with

Virginia WS to determine whether the proposed action is in compliance with relevant management plans, laws, regulations, policies, orders, and procedures.

Consistency

Wildlife damage management conducted in Virginia will be consistent with MOUs and policies of APHIS-WS, the VDGIF, VDACS, VDOT, VDOF, VDEQ, USFWS, USACE, and the EA. The agencies may, at times, restrict damage management that concerns public safety or resource values.

The analyses in the EA demonstrate that Alternative 3: 1) best addresses the issues identified in the EA, 2) provides safeguards for public health and safety, 3) provides WS the best opportunity to reduce damage while providing low impacts on non-target species, 4) balances the economic effects to agricultural and natural resources, and property, and 5) allows WS to meet its obligations to the VDGIF and other agencies or entities.

Monitoring

The Virginia WS program will annually provide to the VDGIF the WS take of target and non-target animals to help insure the total statewide take (WS and other take) does not impact the viability of beaver or muskrat populations as determined by the VDGIF. In addition, the EA will be reviewed each year to ensure that it and the analysis are sufficient. The largest number of beaver removed by Virginia WS to resolve damage problems in any year was 133 beaver in FY 99 (Table 1). However, the public involvement process for this EA resulted in an increased public awareness of Virginia WS damage management assistance. As a result, there is a potential for increased requests for assistance with beaver or muskrat damage problems and the potential requirement for the removal of a larger number of beaver. It is unlikely that WS would remove 5,000 beaver annually in Virginia; however, this number was chosen for the analysis to demonstrate the low impact to the beaver population in Virginia.

Table 1. Beaver Population Estimates and Take in Virginia Including the WS Program for FY 99.

	Conservative Beaver Population Estimate	More Probable Beaver Population Estimate
Est. Population	99,479	129,322
WS Kill FY-99	133	133
Private Take (VDGIF data)	2,975	2,975
Total Kill	3,108	3,108
WS Kill - % of Population	0.1%	0.1%
Other Kill - % of Population	2.9%	2.3%
Total Kill - % of Population	3.1%	2.4%

As stated above, 133 beaver was the most beaver removed by Virginia WS in any previous year. The most likely anticipated take in the next 12 months is 1,800 - 2,400 beaver. For analysis purposes and to consider the scenario of additional requests, WS will conduct an analysis for removing up to 5,000 beaver annually in Virginia. According to the population analysis in the pre-decisional EA, Chapter 4, page 6, a maximum harvest of 5,000 beaver annually would account for about 5% of the conservative beaver population estimate (Table 2).

Based on research studies, USDA (1997, Table 4-2) stated that beaver populations could sustain an annual harvest rate of up to 30% without declining (Novak 1987). Virginia WS beaver damage management harvest and private take was 3,108 beaver or 3.1% of the minimum population (Table 1) and 2.4% of the more probable population. Thus, current cumulative take appears to be far below the level that would begin to cause a decline in the population and thus of the low magnitude of impact.

Assuming a maximum WS take of 5,000 beaver annually and including the number of beaver harvested under the Virginia Department of Game and Inland Fisheries (VDGIF) regulated harvest season or "Kill Permits" in 1998-1999 (see Table 4-2 in the EA), the total take of beaver is only 8% of the more conservatively estimated beaver population (Table 2) and of the low magnitude of impact (USDA 1997).

Muskrats are considered abundant in Virginia and scattered in suitable habitat throughout the State. WS killed only 26 muskrats for depredation purposes from FY97 through 99. It is highly unlikely that the program would kill more than 3000 muskrats in the entire state in any one year under the proposed action which would be more than a 1000% increase in the Virginia WS program for muskrat damage management. Private harvest as reported by VDGIF during the 1998-1999 regulated harvest season was 4,389 muskrats, as estimated by the number of pelts reported sold.

Table 2. Beaver Population Estimate and Analysis of Take in Virginia

Conservative Population Estimate	99,479
Maximum WS Kill	5,000
Private Take (1998-1999 VDGIF data)	2,975
Total Kill	7,975
WS Kill: % of Population	5%

Muskrats are highly prolific and produce 3-4 litters per year that average 5-8 young per litter (Wade and Ramsey 1986) which are characteristics that make them relatively immune to overharvest (Boutin and Birkenholz 1987). Harvest rates of three to eight per acre have been reported to be sustainable in muskrat populations (Boutin and Birkenholz 1987). Assuming, very conservatively, that muskrats occupy only 1% of the 808,000 acres of freshwater wetlands in Virginia (Virginia Department of Environmental Quality 1999), then harvest totaling more than 24,240 per year could be sustainable. Clearly, any mortality as a result of fur harvest or damage management would have a imperceptible impact on the population.

Public Involvement

Issues related to the proposed action were initially developed by an interdisciplinary team involving the VDGIF, VDACS, VDOF, VDOT, and USACE. This Multi-agency team refined the issues and identified preliminary alternatives. Due to interest in the Virginia WS Program the Multi-agency Team concurred that Virginia WS include public involvement in this EA process. An invitation for public comment letter containing issues, objectives, preliminary alternatives, and a summary of the need for action, was sent to 322 individuals or organizations identified as interested in Virginia WS or VDGIF projects. Notice of the proposed action and invitation for public involvement was placed in four newspapers (Richmond Times-Dispatch, The Virginia Pilot, The Roanoke Times, and The Washington Times) with circulation throughout Virginia. There was a 30-day comment period for the public to provide input on the development of the EA. Initial comments from the public were documented from 17 letters or written comments. WS released a pre-decisional EA approximately 14 months after the initial public comment period. As noted in the initial public comment letter, the EA was sent to the 17 commentors and availability of the EA was advertized in the same four newspapers, and there was a second 30-day comment period. A total of seven comment letters were received from the public after review of the pre-decisional EA. Four letters were from out-of-state animal advocacy groups and one from an in-state animal advocacy group, one in-state homeowner's association, and the Penobscot Indian Nation. All comments were analyzed to identify substantial new issues, alternatives, or to redirect the program. All letters and responses are maintained in the administrative file located at the Virginia WS State Office, P.O. Box 130, Moseley, Virginia 23120.

Major Issues

The EA describes the alternatives considered and evaluated using the identified issues. The following issues were identified as important to the scope of the analysis (40 CFR 1508.25).

- Effects on beaver and muskrat populations
- Effects on plants and other wildlife species, including T&E species
- Effects on public and pet health and safety
- Humaneness of methods to be used
- Effects on wetlands and wetlands ecosystem
- Effects on landscaping and native vegetation
- Impacts to stakeholders, including aesthetics

Affected Environment

The areas of the proposed action include state and interstate highways and roads, and railroads and their right-of-ways where beaver activities could cause damage. The areas could also include property in or adjacent to subdivisions and business and industrial parks where beaver impound water and gnaw or fell trees. Additionally, affected areas include timberlands, croplands, and pastures that experience financial losses from beaver flooding or gnawing. The proposed action could also include private and public property where muskrat burrowing damages dikes, ditches, ponds, and levees, and where muskrat feeding causes agricultural crop losses and negatively impacts recovery of T&E species, primarily mussels.

Alternatives That Were Fully Evaluated

The following Alternatives were developed by the Multi-agency Team to respond to the issues. Four additional alternatives were considered but not analyzed in detail. A detailed discussion of the effects of the Alternatives on the issues is described in the EA; below is a summary of the Alternatives.

- Alternative 1 - No WS Beaver or Muskrat Damage Management in Virginia. This alternative would result in no assistance from WS in reducing beaver or muskrat damage in Virginia. WS would not provide technical assistance or operational damage management services. Alternative 1 was not selected because WS is charged by law and reaffirmed by a court decision to reduce damage caused by wildlife (U. S. District Court of Utah 1993). This alternative would not allow WS to meet its statutory responsibility for providing assistance or to reduce wildlife damage. In addition, Alternative 1 violates MOUs between APHIS-WS and the VDGIF and VDACS whereby the VDGIF and VDACS mutually recognize that management of wildlife damage in Virginia is important and may involve wildlife damage management to achieve management objectives.

- Alternative 2 - Only Lethal Beaver and Muskrat Damage Management. Under this alternative, only lethal operational damage management and technical assistance would be provided by WS. Alternative 2 was not selected because it would not allow WS to: 1) respond to all requests, 2) monitor the implementation of producer used non-lethal methods, and 3) asssist the VDGIF or USFWS in meeting wildlife management objectives.

- Alternative 3 - Fully Integrated Beaver and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action). This alternative would allow for technical assistance, non-lethal and lethal beaver and muskrat damage management based on the needs of multiple resources (agricultural and natural resources, property, and public health and safety) and would be implemented following consultations with the VDGIF, other state and federal agencies or Tribes, as appropriate. This alternative would allow for a Virginia WS program to protect multiple resources on all land classes at the request of the land management agency or individual if a Cooperative Agreement and/or Agreement for Control with Virginia WS, as appropriate, are in place. Alternative 3 conforms to the MOUs between WS, the VDGIF and VDACS that recognize that the management of wildlife damage in Virginia is important to achieve land and resource management objectives. Analysis of Alternative 3 showed low level of impact for the target species, non-target species and T&E species.

  The No Action Alternative was analyzed and used as a baseline for comparing the effects of the other Alternatives as required by 40 CFR 1502.14(d). This alternative consists of the current program of technical assistance and operational IWDM (WS Directive 2.105) by Virginia WS on lands under Cooperative Agreement

and Agreement for Control. The current program direction is primarily for the protection of roadways, railroads and property.

- Alternative 4 - Technical Assistance Only. Under this alternative, Virginia WS would not conduct operational beaver and muskrat damage management in Virginia. The entire program would consist of only technical assistance and all operational beaver and muskrat damage management by WS in Virginia would be eliminated. Alternative 4 was not selected because it would not allow WS to: 1) respond to all requests, 2) monitor the implementation of producer used non-lethal methods, 3) assist the VDGIF or USFWS in meeting wildlife management objectives, 4) address all public health and safety requests, and 5) allow WS to assist with beaver and muskrat damage as requested.

- Alternative 5 - Non-lethal Beaver and Muskrat Damage Management. This alternative would not allow the use of lethal methods by WS as described under the proposed action. Only non-lethal methods could be implemented by Virginia WS to reduce damage caused by beaver or muskrats. Alternative 5 was not selected because it would not allow WS to: (1) respond to all requests, (2) monitor the implementation of producer used non-lethal methods, (3) assist the VDGIF or USFWS in meeting wildlife management objectives, (4) address all public health and safety requests and (5) it would leave some of the public without a means to alleviate beaver and muskrat damage.

Alternatives Considered but not Analyzed in Detail are the Following:

Eradication and Suppression. The eradication and suppression alternative would direct all Virginia WS program efforts' toward planned, total elimination or large-scale suppression of beaver and muskrats. Eradication of beaver and muskrats in Virginia is not supported by the public, VDGIF or WS. WS operates according to international, federal, and state laws and regulations enacted to ensure species viability. In addition, Virginia has several state policies that direct agencies to consider biological sustainability when making management decisions (Defenders of Wildlife and Center for Wildlife Law 1996). For instance, the policy of the VDGIF is to manage the State's wildlife resources *"to maintain optimum populations of all species to serve the needs of the Commonwealth."* Virginia also has separate acts that cover plant and animal endangered species (Virginia Annotated Code (VAC) §§29.1-563; VA Reg. 325-01 et seq.) (Defenders of Wildlife and Center for Wildlife Law 1996) and efforts to eradicate a native species would, at some point, initiate listing as a threatened or endangered species.

Suppression would direct Virginia WS program efforts toward managed reduction of certain problem wildlife populations or groups. To consider large-scale population suppression as a goal of the Virginia WS program is not realistic, practical or allowable under present WS policy. In addition, Virginia WS activities are and are expected to be conducted on only a small portion of the area where beaver or muskrat damage occurs. In FY 1999, WS only conducted beaver or muskrat damage management on about 0.054% of the area of Virginia (MIS 1999).

This alternative was not considered by Virginia WS in detail because: (1) WS is opposed to the eradication or large scale suppression of any native wildlife species, (2) VDGIF opposes the eradication or large scale suppression of any native Virginia wildlife species, (3) the eradication or large suppression of a native species would be extremely difficult, if not impossible to accomplish, (4) eradciation or suppression would be cost prohibitive, and (5) eradication is not acceptable to most people.

Population stabilization through birth control.

Under this alternative, beaver and muskrat populations would be managed through sterilization or contraceptives. This alternative would implement the use of chemicals or surgical procedures to inhibit reproduction of beaver and muskrat, and ultimately reduce population levels. Reduction of local populations would result from natural mortality combined with reduced fecundity. No beaver or muskrats would be killed directly under this alternative, however, treated beaver and muskrats would continue to cause damage. Populations of dispersing beaver and muskrats would probably be unaffected.

Contraceptive measures for mammals can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immuno-contraception (the use of contraceptive vaccines). These techniques would require that beaver or muskrats receive either single, multiple, or possibly daily treatment to successfully prevent conception. Chemical sterilants can be classified into one of three types: chemosterilants, immunocontraceptives, and temporary, short-term contraceptives. Chemosterilants have been suggested as a means to managing beaver populations (Davis 1961, Arner 1964). Several reproductive inhibitors have been proposed for use in beaver population reduction, including quinestrol (17-alpha-ethynyl-estradiol - 3-cyclopentylether) and mestranol (Gordon and Arner 1976, Wesley 1978). While chemosterilants have been shown to reduce beaver reproduction in controlled experiments, there are no practical, effective methods for distributing chemosterilants in a consistent way to wild, free-ranging beaver populations (Hill et al.1977, Wesley 1978).

As with chemical repellents and toxicants, a reproduction inhibitor could pose potential risks to non-target wildlife and the environment. Any material would have to be intensively tested and approved for use. Inhibition of reproduction may also affect behavior, physiological mechanisms, and colony integrity (Brooks et al. 1980). Additional research is needed before the environmental effects, and effects to populations and individual animals, from reproductive inhibitors are known. In addition, the use of chemosterilants or immunocontroceptives would be subject to approval by federal and state agencies. Currently, there are no chemical reproductive inhibitors registered to use for beaver and muskrat damage management in the United States. Should a technique or chemical become registered and approved for use in Virginia, it would be incorporated into the IWDM Program in Virginia.

This alternative was not considered in detail because: (1) it would take a number of years of implementation before the beaver or muskrat population would decline, and, therefore, damage would continue at the present unacceptable levels for a number of years; (2) surgical sterilization would have to be conducted by licensed veterinarians, would therefore be extremely expensive; (3) it is difficult to effectively live trap or chemically capture the number of beaver or muskrats that would need to be sterilized in order to effect an eventual decline in the population; (4) no chemical or biological agents for contracepting beaver or muskrats has been approved for use by state and federal regulatory authorities. Therefore, use of contraceptives at present is not realistic since there are no effective and legal methods.

Compensation for Wildlife Damage Losses. The Compensation Alternative would direct all Virginia WS program efforts and resources to the verification of losses from beaver and muskrats and providing monetary compensation. WS services would not include any direct damage management nor would technical assistance or non-lethal methods be provided. This alternative was eliminated from detailed analysis in USDA (1997) because of many disadvantages such as: (1) the alternative would require large expenditures of money and a large work force to investigate and validate all losses and to determine and administer appropriate compensation, (2) compensation would likely be below full market value and many losses could not be verified, (3) compensation would give little incentive to resource owners to limit damage through management strategies, (4) not all property owners/managers would rely completely on compensation and lethal control of beaver and muskrats would most likely continue as permitted by state law, and (5) Congress has not appropriated funds to compensate for wildlife damage.

Bounties. Bounties or payment of funds for killing animals suspected of causing economic losses is not supported by the VDGIF and VDACS. Virginia WS concurs with these agencies because: (1) bounties are generally not effective in managing wildlife, (2) circumstances surrounding take of animals are largely unregulated, (3) no process exists to prohibit taking of animals from outside the damage management area for compensation purposes, and (4) Virginia WS does not have the authority to establish a bounty program.

Finding of No Significant Impact

The analysis in the EA indicates that there will not be a significant impact, individually or cumulatively, on the quality of the human environment as a result of this proposed action. I agree with this conclusion and therefore find that an EIS need not be prepared. This determination is based on the following factors:

1. Beaver and muskrat damage management, as conducted by WS in Virginia, is not regional or national in scope.

2. The proposed action would pose minimal risk to public health and safety.

3. There are no unique characteristics such as park lands, prime farm lands, wetlands, wild and scenic areas, or ecologically critical areas that would be significantly affected.

4. The effects on the quality of the human environment are not highly controversial. Although there is some opposition to wildlife damage management, this action is not highly controversial in terms of size, nature, or effect.

5. Based on the analysis documented in the EA and the accompanying administrative file, the effects of the proposed damage management program on the human environment would not be significant. The effects of the proposed activities are not highly uncertain and do not involve unique or unknown risks.

6. The proposed action would not establish a precedent for any future action with significant effects.

7. No significant cumulative effects were identified through this assessment. The number of beaver and muskrat taken by WS, when added to the total known other take of both species, falls well within allowable harvest levels.

8. The proposed activities would not affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places, nor would they likely cause any loss or destruction of significant scientific, cultural, or historical resources.

9. An informal consultation with the USFWS confirmed that the proposed action would not likely adversely affect any T&E species.

10. The proposed action would be in compliance with all federal, state, and local laws imposed for the protection of the environment.

Decision and Rationale

I have carefully reviewed the EA and the input from the public involvement process. I believe that the issues identified in the EA are best addressed by selecting Alternative 3 (*Fully Integrated Beaver and Muskrat Damage Management for all Private and Public Land* - No Action & Proposed Alternative in the EA) and applying the associated mitigation and monitoring measures discussed in Chapter 3 of the EA. Alternative 3 would provide the greatest effectiveness and selectivity of methods available, the best cost-effectiveness, and has the potential to even further reduce the current low level of risk to the public, pets, and T&E species. WS will continue to use currently authorized wildlife damage management methods in compliance with all the applicable mitigation measures listed in Chapter 3 of the EA. I have also adopted the Pre-Decisional EA *"Reducing Aquatic Rodent Damage Through an Integrated Wildlife Damage Management Program in the Commonwealth of Virginia"* with the Decision Appendix A (Supplement) as the final. Most comments identified from public involvement were minor and did not change the analysis.

For additional information regarding this decision, please contact Martin Lowney, APHIS-WS, P. O. Box 130, Moseley, Virginia 23120, telephone (804) 739-7739.

Ruth D Owens 11/1/00

for Gary E. Larson, Regional Director — Date
APHIS-WS Eastern Region

Literature Cited:

Arner, D. H. 1964. Research and a practical approach needed in management of beaver and beaver habitat in the Southeastern United States. Trans. N. Am. Wildl. Conf. 29:150-158.

Brooks, R. P., M. W. Fleming, and J. J. Kennelly. 1980. Beaver colony response to fertility control: Evaluating a concept. J. Wildl. Manage. 44:568-575.

Boutin, S. and D. E. Birkenholz. 1987. Muskrat and round-tailed muskrat. pp. 282-313 *in* M. Novak, J. A. Baker, M.E. Obbard, B. Mallock. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Davis, D. S. 1961. Principles for population control by gametocides. Trans. N. Am. Wildl. Conf. 26:160-166.

Defenders of Wildlife and the Center for Wildlife Law. 1996. Saving biodiversity: a status report on State laws, policies and programs. Defenders Wildl. and Center for Wildl. Law, Washington, D.C. 218pp.

Gordon, K. L., and D. H. Arner. 1976. Preliminary study using chemosterilants for control of nuisance beaver. proc. Southeast Assoc. of Game and Fish Comm. 30: 463-465.

Hill, E. P., D. N. Lasher, and R. B. Roper. 1977. A review of techniques for minimizing beaver and white-tailed deer damage in southern hardwoods. Proc. Annu. Symp. on Southeastern Hardwoods. 2: 79-93.

MIS (Management Information System). 1997. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS, State Office, P.O. Box 130, Moseley, VA 23120.

MIS. 1998. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS, State Office, P.O. Box 130, Moseley, VA 23120.

MIS. 1999. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS, State Office, P.O. Box 130, Moseley, VA 23120.

Slate, D. A., R. Owens, G. Connolly and G. Simmons. 1992. Decision making for wildlife damage management. Trans. North Am. Wildl. Nat. Res. Conf. 57:51-62.

The Wildlife Society. 1992. Conservation policies of The Wildlife Society: A stand on issues important to wildlife conservation. The Wildlife Society, Bethesda, Md. 24pp.

USDA U.S. Department of Agriculture). Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC). 1997. Final Environmental Impact Statement. USDA, APHIS, ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

U.S. District Court of Utah. 1993. Civil No. 92-C-0052A, January 1993.

Virginia Department of Environmental Quality (VDEQ). 2000. Virginia's water resources: Shaping our lives and our land. Virginia Explorer. Winter 2000: pg.2

Wade, D. A., and C. W. Ramsey. 1986. Identifying and managing aquatic rodents in Texas: beaver, nutria and muskrats. Texas Agric. Ext. Serv., Texas A&M Univ., College Station.

Wesley, D. E. 1978. Beaver control in the southeast United States. Proc. Ann. Hardwood sym. of the Hardwood Res. Council 6:84-91.

WS Directive 2.105. The ADC Integrated Wildlife Damage Management Program

WS Directive 2.201 ADC Decision Model

APPENDIX A

Response to Comments
to the
Environmental Assessment for

REDUCING AQUATIC RODENT DAMAGE THROUGH AN INTEGRATED WILDLIFE DAMAGE MANAGEMENT PROGRAM IN THE COMMONWEALTH OF VIRGINIA

WS received seven comment letters from the public involvement process and review of the pre decisional EA. NEPA requires that proper consideration be given to all reasonable points of view, particularly as they may relate to the issues being considered. In this light, it is important to consider and address concerns or criticisms that may arise. Appendix A is a summary of comments, particularly, criticisms and concerns received from review of the pre decisional EA, with the corresponding WS responses. See Appendix A of the EA for a more complete *"Literature Cited"* and Chapter 5 for the list of preparers, consultants and reviewers.

Issue 1: Beaver fecundity is density dependent and trapping increases litter size (i.e., compensatory reproduction) and trapped beavers are quickly replaced by dispersers (re-colonization).

Program Response: Concern was expressed that removing beaver would not resolve damage problems because beaver fecundity is density dependent and dispersing beaver would re-colonize the site. WS' objective is not to manage beaver or muskrat populations in Virginia, but rather to address requests for assistance to reduce damage at specific sites. The effects of WS' beaver and muskrat damage management are limited to specific damage sites and no density dependent effects have been identified in the statewide population.

Fecundity: Studies have reported that beaver fecundity may be density dependent and that lower densities may cause an increase in litter size (Novak 1987). However, density and dispersal are also reported as a function of many factors such as habitat (water quality, drought conditions, and food), mortality (trapping, predation, and disease), and behavior (territorial activities and intrafamily aggression) (Aleksiuk 1970 as cited in Novak 1987, Tyurnin 1983 as cited in Novak 1987, Novak 1987). Other factors were also identified as possibly influencing fecundity. The dominant female in a family breeds each year whether it is in good or a poor habitat and whether it is in a trapped or static population (Novak 1977 as cited in Novak 1987, Wigley et al. 1983 as cited in Novak 1987). And it is reported that litter size can vary from such factors as food availability and quality (Longley and Moyle 1963 as cited in Novak 1987, Huey 1956 as cited in Novak 1987, Gunson 1967 as cited in Novak 1987), elevation (Rutherford 1964 as cited in Novak 1987, Harper 1968 as cited in Novak 1987) weight of the female (Wigley et al. 1983 as cited in Novak 1987, Pearson 1960 as cited in Novak 1987, Novakowski 1965 as cited in Novak 1987, Henry and Bookout 1969, Gunson 1970 as cited in Novak 1987, Boyce 1974 as cited in Novak 1987), and age of the female (Henry and Bookout 1969, Lyons 1979, Payne 1984, Gunson 1967 as cited in Novak 1987, Morris 1976 as cited in Novak 1987).

Dispersal: As stated in the EA, a minimum estimated beaver population in Virginia is 99,479. However, WS has found that the average number of beavers per family in Virginia is 3.9 (MIS 1999). Using this figure, a reasonable estimate of beaver, given the miles of stream and using the lowest estimate for beaver families per mile of stream is 129,322 beavers. WS only killed 52, 81, and 133 beavers in FY97, 98 and 99, or an estimated 0.08, 0.89 and 4.8% of the estimated take, respectively (Table 1 & 2). During the 1998-99 regulated harvest season, harvest was 1,685 beavers with an estimated additional 1,290 beavers taken under Kill Permits to alleviate damage to property or 2.3 to 2.9% of the estimated population (Table 2) (R. Farrar, VDGIF, letter to M. Lowney, WS, December 29, 1999). Therefore, the effect of a take on the beaver populations is very low and take is not causing a mass dispersal of beaver from occupied territories into vacant territories.

Re-colonization: The issue of re-colonization by dispersing beaver is addressed in sections 4.2.2 and 4.2.3 of the EA where it states that *"new beaver or muskrats would likely re-inhabit the site as long as suitable habitat exists. The amount of time until new beaver or muskrats move into the area would vary depending on the habitat type, time of year, and population densities in the area. In our experience in Virginia, some areas are re-colonized by beaver in 6 - 24 months."* Prior to conducting direct damage management activities, WS informs cooperators that dispersing beaver may re-inhabit the site if adequate habitat remains and that removal may need to be conducted again at that time. Cooperators generally understand and are most interested in immediate solutions to their damage problems and are willing to conduct regular trapping at the site if necessary.

Table 1. Beaver Harvest Data for Virginia (MIS 1996, 1997, 1998, 1999, VDGIF 1998:15).

Beaver Harvest Data	1996	1997	1998
WS Kill	8	52	81
# Taken During State Regulated Harvest Season[1]	9,418	5,811	1,685
%WS Take (% of total take)	0.08	0.89	4.8

[1] Estimated take based on pelts reported sold

Removing problem animals periodically is generally more ecologically sound than altering the riparian or wetland habitats to lower carrying capacity. Most people equate and prefer periodic management as maintenance of a domain, i.e., they would rather mow a lawn weekly than to remove the turf and substitute it with rocks, gravel or other lower maintenance materials.

Table 2. Beaver Population Estimates and Take in Virginia for FY 99.

	Conservative Beaver Population Estimate	More Probable Beaver Population Estimate
Est. Population	99,479	129,322
WS Kill FY-99	133	133
Private Take (VDGIF data)	2,975	2,975
Total Kill	3,108	3,108
WS Kill - % of Population	0.1%	0.1%
Other Kill - % of Population	2.9%	2.3%
Total Kill - % of Population	3.1%	2.4%

Issue 2: Recommend a Discussion on Threshold of Damage that Trigger Activities

Program Response: This comment highlights the sometimes differing interests and needs of the public as they relate to wildlife and wildlife damage management, and the resulting position that wildlife management agencies find themselves. Concern was raised during public involvement that WS should not conduct wildlife damage management until economic losses become unacceptable, and that WS should not initiate any damage management actions until losses reach some predetermined *"threshold"* level. Although some losses can be expected and tolerated by most people and government entities, WS has the legal authority to respond to requests for wildlife damage management (Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c). WS uses the Decision Model (Slate et al. 1992) discussed in Chapter 3, pages 3-5 to determine an appropriate strategy, and it is program policy to aid each requester to minimize losses. If damage management efforts are not initiated soon after a damage problem is detected, damages may escalate to excessive levels, or in the case of human health and safety, people may be injured or killed before the problem is resolved.

In the Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for preliminary injunctions. In part, the court found that a forest supervisor needs only show, that damage is probable to establish a need for wildlife damage management (U.S. District Court of Utah 1993).

Issue 3: Giardia Section in the EA was over Simplified, Misleading and Outbreaks Occur from Human Waste and Seldom from Beaver

Program Response: This commentor is partially correct. Giardiasis is a disease caused by the intestinal parasite *Giardi lamblia*, which may be carried by beaver and muskrats and may cause disease in humans (Davidson and Nettles 1997, Beach and McCullough 1985, Miller and Yarrow 1994, Erlandsen et al. 1990). Although most outbreaks of giardiasis are attributable to the contamination of water supplies by human waste (Erlandsen et al. 1990), animals have also been incriminated as the source of the parasite in some outbreaks (Davidson and Nettles 1997). Beavers have specifically been linked with the occurrence of *G. lamblia* at some sites (Davidson and Nettles 1997). WS would rely on the expertise of public health departments to determine the source of disease outbreaks. WS would not conduct any beaver damage management to protect against giardiasis unless assistance was requested by a public health department that had determined that beaver presence posed a public health risk.

Issue 4: Increase Public Educational Outreach Efforts

Program Response: Beavers play an important ecological role, creating valuable wetlands and wildlife habitat, as described in Section 1.2.1 of the EA. WS works to educate the public about wildlife benefits as well as about wildlife damage management options. Education is an important part of WS' program because WS believes wildlife damage management is about finding *"balance"* or coexistence between the needs of people and needs of wildlife (USDA 1997). As requested, WS conducts demonstrations and presentations for property owners sustaining damage and other interested parties. Additionally, WS provides informational leaflets; in FY's 1998 and 1999, the Virginia WS program provided 99 and 62 leaflets, respectively, to the public about beaver and beaver damage management. Materials distributed included information about the biology, ecology, legal status and benefits provided by beaver as well as non-lethal and lethal damage management methods to reduce damage.

Issue 5: Concern about the Lack of Virginia Specific Damage Data and Table 1-1 of the EA did not have FY 99 damage data.

Program Response: A comprehensive damage survey, specific to Virginia, has not been conducted by WS or any other agency, however, WS compiles damage data when it is reported by requesters and this was included in the EA (Section 1.4). In addition, the EA include references and data that are more applicable to Virginia whenever possible. The EA also included references to a number of damage studies conducted in other parts of the country, and these were included only if they were judged to be relevant to resources or probable scenarios in Virginia.

Table 3. Beaver and Muskrat Damage Incidents and Economic Loss ($)

(MIS 1996, 1997, 1998, 1999).

FY	Species	Incidents	Agriculture[1]	Natural Resources	Property[2]	Public Health/Safety
96	Beaver	24	2,100			
	Muskrat	4				
97	Beaver	26	5,800	3,600	2,000	
	Muskat	3			1,100	
98	Beaver	128	2,000		44,120	1[3].
	Muskrat	3			232	
99	Beaver	89	31,550	15,100	1,600	
	Muskrat	12			93,000	

[1] Includes commercial forestry, agricultural crops and pasture.

[2] Includes landscaping, turf, gardens, equipment, vehicles, roads, etc.

The damage data for beaver and muskrat in Virginia for federal FY96-99 are summarized (Table 3). This table provides the number of damage incidents (generally a request for assistance) for beaver and muskrats and the estimated economic loss reported to WS for each type of resource affected. The economic losses are probably under-reported, as losses are not estimated or available each time a damage incident is reported.

Issue 6: The Animal Protection Institute (API) wanted an Alternative *"Technical Assistance and Non-lethal Beaver and Muskrat Damage Management with Lethal Management as a Last Resort"* included in the EA.

Program Response: This alternative would restrict and require Virginia WS and others to conduct non-lethal damage management before using lethal damage management. Verification of the methods used would be the responsibility of the Virginia WS. No standards exist to determine the diligence in applying non-lethal methods, nor are there standards to determine how many non-lethal methods or applications are necessary before the initiation of lethal damage management. Thus, only the presence or absence of non-lethal methods can be evaluated.

Currently, technical assistance and operational non-lethal and lethal damage management is provided in the context of an IWDM approach to most efficiently and effectively resolve damage problems, and the WS Decision Model (Slate et al. 1992) is used to help determine the best approach for resolving wildlife damage. The current Virginia WS Program recognizes the importance of non-lethal methods as an important dimension of IWDM and non-lethal methods are considered or used first in each damage management strategy, if applicable, as described in the Proposed Alternative. These non-lethal methods are promoted through program directives, literature and in personal consultations with affected resource owners. Protection of resources is Virginia WS' objective, and WS is available to all who request assistance. Technical assistance and non-lethal information will continue to be provided by WS to anyone that asks for that information.

In addition, the API alternative does not allow for a timely full range of IWDM techniques to resolve wildlife damage problems and may compromise damage resolution in some cases (i.e., crop flooding, flooded roads, road beds, or human health and safety). In addition, WS is authorized to protect American agricultural and natural resources, property, and human health and safety (Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c). In addition, considerations of wildlife needs, including T&E Species and Species of Special Concern, are not included with the API technical and non-lethal alternative methods.

Issue 7: Concept of *"Healthy"* Wildlife Populations and the Identification of Social and Biological Carrying Capacities

Program Response: Wildlife Acceptance Capacity (WAC), or Cultural Carrying Capacity (CCC), is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations (Decker and Purdy 1988). WAC is not a static number, but is defined by numerous dynamic factors such as people's acceptance thresholds for damage and nuisance associated with the wildlife species in given situations, perceived interspecific competition, the role of the species in the transmission of disease to humans or other animals, and the values placed by people on this species. These values include economic, aesthetic, ecological, scientific, intrinsic, or educational values (Decker and Purdy 1988). Thus, different groups or individuals may have different WAC's for the same species at any given time, dependent upon their values and tolerances.

Because of the dynamic nature of WAC's, WS has not defined these limits in the EA. WAC's are determined on a site-specific basis by the individuals or organizations sustaining damage from beaver or muskrats.

Biological Carrying Capacity (BCC) is the land or habitat's limit for supporting healthy populations of wildlife without degradation to the animals' health or their environment over an extended period of time (Strickland et al. 1994, Decker and Purdy 1988, Wolfe and Chapman 1987). In this context, a healthy population is one in which the animals do not suffer from a scarcity of necessary resources such as food, water, shelter, or space. Precise estimates of BCC are rarely if ever available (Strickland et al. 1994) and in agricultural and urbanized areas BCC generally greatly exceeds the WAC and is therefore only of academic interest (Strickland et al. 1994). Like the WAC, BCC is also dynamic in that it fluctuates in response to variations in environmental conditions such as weather or seasonal changes or changes in land

use and development that affect the availability of food or other habitat requirements (Wolfe and Chapman 1987). Thus, BCC is difficult to define and is best left as a general concept rather than a definable entity (Wolfe and Chapman 1987).

Issue 8. A Concern was Expressed about Injuries to Otter from Leg-hold Traps and Hancock Traps and that to Reject the Use of Hancock Traps was Prejudicial.

Program response: WS noted in the pre decisional EA that river otters are a species of special concern and would be considered a non-target animal during beaver and muskrat damage abatement projects. The use of Hancock traps was rejected in Section 2.2.2.1, *"Effects on River Otters, a Virginia Species of Special Concern" and in Section 3.4.6, "Hancock Traps"* in the EA. WS rejected the use of Hancock Traps for five reasons: (1) life threatening injuries to river otters, (2) safety threat to humans, (3) there are more efficient methods to live capture beaver, (4) impractical to use, and (5) cost.

Hancock traps also poses more danger to set than other traps and the manufacturer recommend wearing a hard hat when setting Hancock traps. This threat to human safety is one reason why Hancock traps were rejected.

Blundell et al. (1999) stated *"... tooth damage that occurred from Hancock traps (>45%: Figure 3) is excessive..."* and otters captured in Hancock traps had significantly more serious injuries to their teeth than animals captured in leg-hold traps. Blundell et al. (1999) also said injuries to teeth were more pronounced among canine teeth. Biknevicius and Van Valkenburg (1996) said damage to canine teeth in river otters represents a serious impediment to capturing prey because they capture prey with their mouths (Estes 1989). Wildlife biologists with state wildlife agencies in the southeastern U.S. consider injuries to river otter canine teeth to be life threatening, because river otters need canine teeth to capture prey and to eat (P. Sumner, NC Wildl. Resourc. Commission, pers. commun.). Since river otters are non-target animals, WS prefers to release these animals back into the wild. Hancock traps would make the release and survival of some river otters unlikely. Moreover, the commentor and Blundell et al. (1999) noted that leg-hold traps also can injure appendages and teeth. However, injuries to teeth from leg-hold traps are less serious and any potential injury to appendages from leg-hold traps often heal with no apparent debilitation (Shirley et al. 1983).

Hancock traps are one type of trap which could be used for live capturing beaver. Snares are another type of capture device which could be used for live capturing beaver. The obvious benefits of using snares are the ease of use when compared to Hancock traps. Most people could carry only one Hancock trap versus carrying numerous snares. Other factors WS would consider if beavers were captured alive would be the impact on otters, and pets and humans. Our experiences with snares are all pet dogs captured in snares were alive and released unharmed. Snares are a very efficient, safe, and a reliable live capture tool as used by WS.

Table 4. Cost of Control Devices for Capturing Beaver.

Device	Approximate Cost ($)[1]
Conibear or body gripping trap, 330 size	16.00
Snare, self made	0.60
Snare, purchased	2.00
Leg-hold trap, MB-750, coil spring	24.00
Leg-hold, # 5 Bridger, long spring	23.00
Hancock trap	275.00

1. Cost are from Minnesota Trapline Products, 200 - 2001 catalog.

The last factor considered before rejecting Hancock traps was cost. Section 3.4.6 in the EA stated Hancock traps cost approximately $275. When a decision is made by the landowner to remove the beaver to alleviate damage, WS considers the cost of equipment and efficacy and practicality. When a cost analysis was conducted (Table 4), it was obvious that Hancock traps were an expensive choice.

In summary, Hancock traps were rejected as a tool because of the above stated factors. This trap can cause life threatening

injuries to river otters, a species of special concern and a non-target animal that WS would release if captured. Also, Hancock traps are a threat to human safety, are expensive, and are more efficient. Safer capture devices and traps are available.

Issue 9: Some Commentors Believed Conibear (body gripping or kill) Traps and Leg-hold Traps are Inhumane, Especially if the Animal Drowns.

Program response: The WS program is also concerned about animal welfare and continuously evaluates existing and new methods because of our concern for animals. WS is conducting trap research at the National Wildlife Research Center and has provided grants of at least $350,000 annually since 1997 to state wildlife agencies to develop Best Management Practices for trapping wild fur bearers. While it is regrettable that wild animals die to alleviate some damage, we believe that if an animal death must occur, then it should occur with a minimum amount of distress and pain, in as short period of time as practical, and with compassion. The American Society of Mammalogist (Baker et al. 1987) also states that, "*Field methods used to sacrifice mammals should be quick, as painless as possible, and compatible with ... the size and behavior of the species of mammals under investigation.*"

Coniber, Body-Gripping, or Kill Traps

The AVMA (Andrews et al. 1993) states, *"Kill traps are practical and effective for animal collection when used in a manner that minimizes the potential for attraction and collection of non-target species."* It appears the AVMA (Andrews et al. 1993) is not objecting to the use of kill traps. In addition, the American Society of Mammalogists recommends using kill traps for medium-sized animals in field investigations (Baker et al. 1987). Also, Conibear (kill traps) has passed the International Humane Trapping Standards for beaver and muskrat (Fur Institute of Canada 2000).

The basic problem associated with animal traps is a lack of defining *"humaneness"* as it relates to animal cruelty (Proulx and Barrett 1991). The definition of humaneness varies between people and cultures (*see* Section 2.2.4 of the EA).

Proulx (1999) reported on state of the art trap technology on the basis of the most stringent animal welfare performance criteria used to date. These criteria established that animals are rendered irreversibly unconscious in < 3 minutes; this standard was initially set for 10-minutes before being reduced to 3 minutes (FPCHT 1981). However, this later standard did not consider human safety. Initially, conibear traps were classified as state of the art trapping devices and later were judged to have failed state-of-the art trapping device standards (Proulx 1999). Novak (1981) found when the striking bars of 330 conibear traps were bent inward, the time to death for beaver was 7 - 9 minutes. However, this modification leaves no space between the striking bars. Proulx et al. (1995) modified 330 conibear traps by welding clamping bars to the striking bars. This results in a trap of similar appearance as Novak (1981) with its bent jaws. A trap modified with clamping bars strikes with 20% more force than a standard 330 conibear trap. Since people using the conibear trap occasionally catch their hands, the full force of the trap would strike the hand, and most likely cause injury. We consider this modification, while more beneficial for animal welfare considerations, a detriment to human safety. While WS is willing to use kill traps that more quickly kill animals, we are unwilling to put our employees or the public at risk for potentially serious injury.

In May 2000, the Canadian government determined standard and modified 330 Conibear traps met the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000) for beaver. They also determined that leg-hold traps with a submersion system, 110 Conibear traps in water and 120 Conibear traps on land meet the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000).

In summary, the Canadian government has determined that standard and modified 330 Conibear traps, 110 and 120 Conibear traps, and leg hold traps on submersion systems met international humane trapping standards, the American Society of Mammologists recommended kill traps for medium-sized animals, and the AVMA is not opposed to kill traps for wildlife.

Drowning as a Form of Euthanasia

Several commentors opposed drowning of beaver and muskrats and considered it inhumane and not euthanasia. There are considerable debate and disagreement among animal activists, some veterinarians, wildlife professionals, fur trappers, and nuisance wildlife control specialists on this issue. The Virginia WS program rarely uses drowning sets when capturing beaver or muskrats. We captured only one beaver (0.4% of beaver caught) in drowning sets during FY 1996 through 1999. We generally use drowning sets as a last resort to remove difficult to catch beaver.

The AVMA (Andrews et al. 1993) states *"... euthanasia is the act of inducing humane death in an animal."* And *"... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness."* Carbon dioxide (CO_2) causes death in animals by hypoxemia and some animals (cats, rabbits, and swine) are distressed before death (Andrews et al. 1993). Even though these animals are distressed, the AVMA (Andrews et al. 1993) states this death is an acceptable form of euthanasia. Thus, the AVMA does not preclude distress or pain in euthanasia. In fact, the AVMA supports inducing hypoxemia related distress when necessary to reduce total distress, because reducing total distress is a more humane death.

The AVMA (Andrews et al. 1993) identifies drowning as an unacceptable method of euthanasia, but provides no literature citations to support this position. Ludders et al. (1999) concluded drowning is not euthanasia. This is based on animals not dying from CO_2 narcosis. Ludders et al. (1999) showed death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia. Ludders et al. (1999) also concluded that animals that drown are distressed because of stress related hormones, epinephrine and norepinephrine, and therefore drowning is not euthanasia.

Gilbert and Gofton (1981) reported that after beavers were trapped, and entered the water, they struggled for 2-5 minutes followed by a period of reflexive responses. Andrews et al. (1993) state that with some techniques that induce hypoxia, some animals have reflex motor activity followed by unconsciousness that is not perceived by the animal. Gilbert and Gofton (1981) state it is unknown how much conscious control actually existed at this stage. And they stated anoxia may have removed much of the sensory perception by 5-7 minutes post submersion.

Ludders et al. (1999) reported CO_2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded. Clausen and Ersland (1970) demonstrated that CO_2 increased in arterial blood while beavers were submersed and CO_2 was retained in the tissues. While Clausen and Ersland (1970) did measure the amounts of CO_2 in the blood of submersed beaver, they did not attempt to measure the analgesic effect CO_2 of buildup to the beaver (letter from V. Nettles, D.V.M., Ph.D., Southeastern Cooperative Wildlife Disease Study to W. MacCallum, MA Division of Fisheries and Wildlife, June 15, 1998).

When beavers are trapped using leg-hold traps with intent to *"drown,"* the beavers are exhibiting a flight response. Gracely and Sternberg (1999) reports that there is stress-induced analgesia resulting in reduced pain sensitivity during fight or flight responses. Environmental stressors that animals experience during flight or fight activates the same stress-induced analgesia (Gracely and Sternberg 1999).

Given the short time period of a drowning event, the possible analgesic effect of CO_2 buildup to the beaver, the minimum if any pain or distress on drowning animals, the AVMA's acceptance of hypoxemia as euthanasia and the AVMA's acceptance of a minimum of pain and distress during euthanasia, the acceptance of catching and drowning muskrats approved by International Humane Trapping Standards (Fur Institute of Canada 2000), we conclude that drowning, though rarely used by WS, is acceptable. We recognize some people will disagree and are unswayed.

Issue 10: Comments were received that water control devices are effective and the EA gave little consideration to water control devices.

Program Response: Several commentors were concerned that water control devices were not given adequate consideration for solving beaver damage problems. The EA addressed the use of water control devices in Chapter 2, page 13, and in Appendix D, pages 2&3. WS stated in the EA that water control devices could be used or recommended if appropriate. However, new information about the use of water control devices has been brought to our attention and this was

considered in evaluating the proposed action.

From the comments received, it appears that there may be some confusion as to the consideration that WS will give to the use of water control devices in solving beaver damage conflicts. If a water control device (fence or pipe system) is consistent with the landowner's objectives, will alleviate the damage, and if funding is available for installation, then WS would use or recommend their use. WS would also provide technical assistance to landowners who want to install these devices on their own.

Water control devices (pond levelers) have been used for many years in many different states, with varying degrees of success. Various types of beaver pond levelers have been described (Arner 1964, Laramie and Knowles 1985, Lisle 1996, NY State Dept. of Environmental Conservation (NYDEC) 1997, Roblee 1984) and installation of pond levelers can be effective in reducing flooding in certain situations (Minn. Dept. Nat. Res. 1994, Miller and Yarrow 1994) if properly maintained. Water control devices are generally of two basic types: pipe systems and fence systems. Pipe systems consist of a perforated pipe passing through the beaver dam and the upstream end of the pipe may be encased in wire mesh. There are numerous types of pipe systems, including the Clemson Pond Leveler (NYDEC 1997, Wood et al. 1994, Wood and Woodward 1992). Fence systems feature a fence erected in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996, NYDEC 1997, B. Gotie and J. Lamindola, NYDEC, pers. commun., 2000). Some fence systems may have a pipe going from the fence to the culvert to allow water to flow since the fence may become clogged with debris (B. Gotie and J. Lamindola, NYDEC, pers. commun., 2000).

The *"Beaver Deceiver"*fence system is a relatively recent water control system that attempts to quiet, calm, and deepen the water around culverts and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). A critical part of the beaver deceiver strategy is to silence or prevent the sound of running water (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000). The beaver deceiver is a water control system that has been evolving since 1996 (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000) and has been effective at controlling beaver flooding in some situations.

One benefit of water control devices is that the beaver pond or wetland area can be maintained or improved, along with the ecological and recreational benefits derived from these areas (see Chapter 1, pages 3&4, of the EA), while the damage from beaver flooding is alleviated or at least reduced. However, water control devices are not applicable or efficient in all damage situations. Landowners consider many factors in determining the course of action to resolve beaver damage problems. For example, landowners must consider the cost of control, the probability that the method will resolve the problem, the amount of maintenance required, and whether the method is consistent with objectives for the property (Nolte et al. 2000). Water control devices are most effective in specific types of terrains and sites, as described in Chapter 2, page 13, of the EA (NYDEC 1997, Wood et al. 1994). Water control devices have required frequent maintenance and may be costly to install and maintain (Chapter 2, page 13, and Appendix D of the EA) (Jensen et al.1999, NYDEC 1997). Jensen et al.(1999) reported that the initial costs for a Clemson Beaver Pond Leveler and a Pitchfork Guard/Grate in the first year, including the costs of materials, installation, and maintenance, were $1,542 and $3,688, respectively. The cost of a Beaver Deceiver may range from $150 - $1,500, and an additional cost would be applied if pipes were needed at the site (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

Nolte et al. (2000) also found that pond levelers placed in sites with high beaver activity without implementing local population control measures frequently failed. Ninety-five percent of the successful levelers in this study were at sites that had received some local population control measure either before, after, or before and after the leveler was installed (Nolte et al. 2000). Wood et al. (1994) also acknowledged that pond levelers do not negate the need for reduction of local beaver populations. Beaver may block the device or may build additional dams upstream or downstream, inhibiting the success or function of the device.

WS has mailed numerous leaflets to landowners, local government, and state agencies about water control devices. However, none of the landowners have chosen to have WS install a water control device. We know of some landowners that have built and installed water control devices and some are pleased with the results, while others will probably not consider using them again.

Issue 11: Flooding Causes Decreased Mast Production

Program Response: As the roots of oaks are saturated and flooded by raised water levels, there is a decrease in growth and mast production followed by death of the tree. The amount of time until the tree is killed varies by species, but is generally only 1-2 years (J. Bassett, VDOF, pers. comm. 2000).

Issue 12: EA Downplayed the Benefits of Beaver on Virginia Wetlands

Program Response: We disagree with this comment and it is reflected in other comments received by WS. The EA went into detail to discuss the benefits of beaver activities and used information provided by commentors to develop that section (Section 1.2.1 of the EA). WS presented a balanced approach to beaver damage management, and discussed both the benefits that beavers provide to the environment and the damage they cause.

Issue 13: Exclusion Methods to Prevent Burrowing in Dikes and Rip-rap Should be Included as a Non-lethal Method

Program Response: WS discussed numerous exclusion methods, including rip-rap, not only to prevent burrowing in dikes, but also to prevent tree damage, plugging culverts and gaining access to other resources (See EA at 3.3.1 and Appendix D).

Issue 14: Competition with Private Businesses

Program Response: WS addressed this issue and the issue of conducting beaver and muskrat damage management in relation to regulated harvest seasons in the pre decisional EA in section 2.4.3.

Issue 15: WS Beaver and Muskrat Damage Management Impact on Otter Populations

Program Response: WS addressed this issue in Section 2.2.2.1 of the pre decisional EA.

Issue 16: WS Should Include a List of and Use Registered Repellents.

Program Response: The only repellent registered to reduce gnawing, nibbling and chewing from beaver is Ropel®. However, chemical repellents, including Ropel®, are not very effective in reducing beaver damage and most people that use *"grit paint"* (see Section 3.3.1 and Appendix D) have better success (Dr. D. Muller- Schwarze, Prof. Environ. Biol., State Univ of New York, Syracuse, pers. comm).

LITERATURE CITED

Aleksiuk, M. 1970. The seasonal food regime of arctic beavers. Ecology 51:264-270.

Andrews, E. J., B. T. Bennett, J. D. Clark, K. A. Houpt, P. J. Pascoe, G. W. Robinson, and J. R. Boyce. 1993. Report on the AVMA Panel on Euthanasia. J. Amer. Vet. Med. Assoc. 202:229-249

Arner, D.H. 1964. Research and a practical approach needed in management of beaver and beaver habitat in the Southeastern United States. Trans. North Amer. Wildl. Nat. Resour. Comm. 29:150-158.

Baker, R. J., G. W. Barrett, E. C. Birney, R. C. Dopwler, J. F. Eisenberg, M. L. Johnson, T. L. Kunz, A. T. Linzey, J. H. Shaw, J. M. Taylor, and B. Wunder. 1987. Acceptable field methods in mammalogy: Preliminary guidelines approved by the American Society of Mammalogists. 68 (suppl. 4):1-18.

Beach, R., and W. F. McCulloch. 1985. Incidence and significance of *Giardia lamblia* (Lambl) in Texas beaver populations. Proc. Great Plains Wildl. Damage Cont. Work. 7:152-164.

Biknevicius, A.R., and B. Van Valkenburgh. 1996. Design for killing: caniodental adaptations of predators. Pages 393-428 *in* J.L. Gittleman, ed. Carnivore behavior, ecology, and evolution. Vol. 2. Cornell Univ. Ithaca, NY.

Blundell, G. M., J. W. Kern, R. T. Bowyer, and L. K. Duffy. 1999. Capturing river otters: a comparison of Hancock and leg-hold traps. Wildl. Soc. Bull. 27:184-192

Boyce, M. S. 1974. Beaver population ecology in interior Alaska. M.S. Thesis, Univ. Alaska, Fairbanks. 161 pp.
Clausen, G. and A. Ersland. 1970. Blood O_2 and acid-base changes in the beaver during submersion. Respiration physiology 11:104-112.

Clausen, G., and A. Ersland. 1970. Blood O_2 and acid-base changes in the beaver during submersion. Respiration Physiology. 11:104-112.

Davidson, W.R. and V.F. Nettles. 1997. Field manual of wildlife diseases in the southeastern United States. 55 pp.

Decker, D.J., and K.G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildl. Soc. Bull. 16:53-57.

Erlandsen, S.L., L.A. Sherlock, W.J. Bemrick, H.G.hobrial, and W. Jakubowski. 1990. Prevalence of *Giardia* spp. In beaver and muskrat populations in northeastern states in Minnesota: Detection of intestinal trophozites at necropsy provides greater sensitivity than detection of cysts in fecal samples. Applied and Environmental Microbiol. 56:31-36.

Estes, J. A. 1989. Adaptations for aquatic living by carnivores. pp 242-282 *in* Carnivore behavior, ecology, and evolution. J. L. Gittleman. ed. Cornell Univ. Press

Federal Provincial Committee for Humane Trapping (FPCHT). 1981. Final report. Committee of the Federal Provincial Wildlife Conference, Ottawa, Ontario. 172 p.

Fur Institute of Canada. 2000. Traps meeting requirements of Agreement on International Humane Trapping Standards. Press Release. June 12, 2000. www.fur.ca/press_releases/results_e.html

Gilbert, F. F. and N. Gofton. 1981. Terminal dives in mink, muskrat, and beaver. Physiology and behavior 28:835-840

Gracely, R. H. and W. F. Sternberg. 1999. Athletes: Pain and Pain Inhibition. American Pain

Society. 9:1-8

Gunson, J. R. 1967. Reproduction and productivity of beaver in Saskatchewan. Presented at the Second Fur Workshop, Quebec City, Que. 25 pp.

Gunson, J. R. 1970. Dynamics of the beaver of Saskatchewan's northern forests. M.S. Thesis Univ. Alberta, 122 pp.

Harper, W. R. 1968. Chemosterilant assessment for beaver. M.S. Thesis, Colorado State Univ., Fort Collins. 40 pp.

Henry, D. B. and T. A. Bookhout. 1969. Productivity of beaver in northeastern Ohio. J. Wild. Manage. 33:927-932.

Huey, W. S. 1956. New Mexico beaver management. N.M. Dep. Game and Fish, Bull. 4. 49pp.

Jensen, P.G., P.D. Curtis, and D.L. Hamelin. 1999. Managing nuisance beavers along roadsides. Cornell Coop. Ext. Service. Cornell, NY. 14 pp.

Laramie, H. A. Jr., and S. W. Knowles. 1985. Beavers and their control. Univ. of New Hampshire Coop. Ext. Service. Wildlife Fact Sheet 10. Durham, NH. 4 pp.

Lisle, S. 1996. Beaver deceivers. Wildl. Control Tech. Sept. - Oct. pp. 42-44.

Longley, W. H. and J. B. Moyle. 1963. The beaver in Minnesota. Minn. Dep. Conserv., Tech. Bull. 6. 87pp.

Ludders, J.W., R.H. Schmidt, F.J. Dein, and P.N. Klein. 1999. Drowning is not euthanasia. Wildl. Soc. Bull. 27:666-670.

Lyons, P. J. 1979. Productivity and population structure of western Massachusetts beavers. Trans. Northeast Sect. Wildl. Soc. 36:176-187.

Miller, J. E., and G. K. Yarrow. 1994. Beavers. pp B1-B11 *in* R. M. Timm, ed. Prevention and control of wildlife damage. Great Plains Agric. Counc., Wildl. Res. Comm. and Nebraska Coop. Ext. Serv., Univ. of Nebraska, Lincoln.

Minn. Dep. Nat. Res. 1994. The clemson beaver pond leveler. St. Paul, MN. 6 pp.

MIS (Management Information System). 1996. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS State Office, P.O. Box 130, Moseley, VA 23120.

MIS. 1997. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS State Office, P.O. Box 130, Moseley, VA 23120.

MIS. 1998. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS State Office, P.O. Box 130, Moseley, VA 23120.

MIS. 1999. Statewide Summary Report. Virginia Wildlife Services. USDA, APHIS, WS State Office, P.O. Box 130, Moseley, VA 23120.

Morris, M. 1976. Beaver productivity - Bruce Peninsula, Owen Sound District. Ontario Minist. Nat. Resour., Toronto. 12 pp.

Nolte, D. L., S. R. Swafford, C. A. Sloan. 2000. Survey of factors affecting the success of Clemson beaver pond levelers installed in Mississippi by Wildlife Services. East. Wildl. Damage Control Conf 10. in press.

Novak, M. 1977. Determining the average size and composition of beaver families. J. Wildl. Manage. 41:751-754.

Novak, M. 1981.Capture test with underwater snares, leg-hold, Conibear and Mohawk traps. Canadian Trapper, April issue: 18-23.

Novak, M. 1987. Beaver. pp 282-312 *in* M. Novak, J.A. Baker, M.E. Obbard, and B. Mallock, eds. Wild Furbearer Management and Conservation in North America. Ontario Trappers Assoc., Ontario.

Novakowski, N. S. 1965. Population dynamics of a beaver population in northern latitudes. Ph D. Thesis, Univ. Saskatchewan, Saskatoon. 155pp.

NYDEC. 1997. Beaver damage control techniques manual. NYDEC Bureau of Wildlife.

Payne, N. F. 1984a. Reproductive rates of beaver in Newfoundland. J. Wildl. Manage. 48:912-917.

Pearson, A. M. 1960. A study of the growth and reproduction of the beaver (castor canadensis Kuhl) correlated with the quality and quantity of some habitat factors. M.S. Thesis, Univ. British Columbia, Vancouver. 103 pp.

Proulx, G. 1999. Review of current mammal trap technology in North America, in Mammal Trapping. Alpha Wildlife Research and Management, Ltd. Alberta, Canada. 1-46.

Proulx, G. and M. W. Barrett. 1991. Idealogical conflict between animal rights and wildlife professionals over trapping wild furbearers. Trans. North Amer. Wildl. and Nat. Resour. Conf. 56:387-399.

Proulx, G., A. J. Kolenosky, P. J. Cole, and R. K. Drescher. 1995. A humane killing trap for lynx (*Felis lynx*): the Conibear 330 with clamping bars. J. of Wildl. Diseases 31:57-61

Roblee, K. 1984. Use of corrugated plastic drainage tubing for controlling water levels at nuisance beaver sites. N.Y. Fish Game J. 31: 63-80.

Rutherford, W. H. 1964. The beaver in Colorado: its biology, ecology, management and economics. Colo. Game, Fish and Parks, Tech. Publ. 17. 49pp.

Shirley, M. G., R. G. Linscombe, L. R. Sevin. 1983. A live trapping and handling technique for river otters. Proc. Annu. Conf. Southeast Assoc. Fish and Wildl. Agencies 37:182-189

Slate, D. A., R. Owens, G. Connolly and G. Simmons. 1992. Decision making for wildlife damage management. Trans. North Am. Wildl. Nat. Res. Conf. 57:51-62.

Strickland, M.D., H.J. Harju, K.R. McCaffery, H.W. Miller, L.M. Smith, and R.J. Stoll. 1994. Harvest management. pp 445-473 *in* T.A. Bookhout, ed., Research and management techniques for wildlife and habitats. The Wildlife Society; Bethesda, Maryland.

Tyurnin, B. N. 1983. Factors determining the number of the river beaver (Castor canadensis) in the European North. Ekologiya 6:43-51. (Trns from Russian).

USDA. 1997. Final Environmental Impact Statement. U.S. Dep. Agric., Anim. Plant Health Inspection Serv., Anim. Damage Control, Operational Support Staff, Riverdale, MD.

U.S. District Court of Utah. 1993. Civil No. 92-C-0052A, January 1993.

Wigley, T. B., Jr., T. H. Roberts and D. H. Arner. 1983. Reproductive characteristics of beaver in Mississippi. J. Wildl. Manage. 47:1172-1177.

Wolfe, M.L., and J.A. Chapman. 1987. Principles of furbearer management. pp 101-112 *in* M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, eds., Wild furbearer management and conservation in North America. Ontario Trappers Assoc., Ontario.

Wood, G.W., and L.A. Woodward. 1992. The Clemson beaver pond leveler. Proc. Annu. Conf. SEAFWA. Pp. 179-187.

Wood, G. W., L. A. Woodward, and G. K. Yarrow. 1994. The Clemson beaver pond leveler. AFW Leaflet 1, Clemson Cooperative Extension Service, Clemson, SC.